
During computer test students have to answer 20 questions of practically oriented tasks, number of right answers is given in brackets after each question.

Task conditions:
An otolaryngologist during a patient’s examination noticed hyperemia and edematous tonsils with grey plaques. During microscopic analysis of the plaques, the laboratory worker observed gram-positive bacilli situated angular to one another. According to these results, the doctor made the diagnosis: diphtheria.

Question 1.
Choose the right Latin name for the agent of diphtheria? (1)
A. +Corynebacterium diphtheriae.
B. Clostridium diphtheriae.
C. Corynebacterium pseudodiphthericum.
D. Staphylococcus aureus.
E. Staphylococcus pyogenes.

Question 2.
Characterize the morphological and tincture properties of diphtheria agent? (3)
A. +Gram-positive bacilli with a bulge at their ends, during microscopic examination they are seen to be situated angular to one another in shape of V, X or Y or form groups with a similar resemblance to dropped matches, and create their own microcapsule.
B. +Don`t have spores or flagella.
C. +Have specific insertions.
D. Gram-positive cocci, forming chain, don`t have spores.
E. Gram-negative spiral bacilli resembling a comma, don`t form spores and capsules.
F. Gram-negative bacilli, don`t form spores and sometimes form capsules.
G. Gram-positive cocci, form spores.
H. Peritrichous.
I. Spiral with polar situated flagella.

Question 3.
Describe the antigen structure of diphtheria agent: (1)
B. Group polysaccharides.
D. O-, H- antigen.
E. Gp-antigen.
F. Vi-antigen.

**Question 4.**
Which methods are used to identify *diphtheriae gravis* and *mitis* biovars? (1)
A. +Cultural properties: gravis biovar often forms grey or black dim dry colonies with radial stripped surface, while mitis biovars form gray or black round colonies with straight boards.
B. Different ferment activity.
C. Different structure of specific polysaccharides.
D. Different hemolysis type.
E. Ability to cooperate with specific bacteriophages.
F. Resistance to polymyxin.
G. Resistance to penicillin.
H. Have flagella.

**Question 5.**
Which pathogenicity factors are usual for diphtheria agent? (4)
A. +Surface of lipid and protein structure (as factors of adhesion and cofactors).
B. +Microcapsule (adhesion factor).
C. +Aggression and invasion ferments.
D. +Exotoxins and histotoxins (main pathogenicity factors).
E. M-protein.
F. Endotoxins.
G. Presence of o-antigen.
H. Presence of spores.
I. Everything mentioned above.

**Question 6.**
Characterize cultural properties of diphtheria agent and choose the right medium for its cultivation: (2)
A. +Facultative anaerobe – bacteria, whose energy cycles consist mostly of anaerobic way of life, but can exist in oxygen presence.
B. Facultative anaerobe – bacteria, whose energy cycles consist most of anaerobic way of life, but cannot exist in oxygen presence.
C. Medium for primary taking – alkaline peptone water, alkaline agar.
D. Bacteria can grow on universal medium.
E. Obligatory anaerobe – bacteria, whose energy cycles consist most of anaerobic way of life, but cannot exist in oxygen presence.
F. Special media - endo and levine.
G. Special medium for primary taking, medium of okelnitski
H. Capnophilic
I. Special media for primary taking – blood-telluric agar and serum agar.

**Question 7.**
**What is the way of infection? Choose the possible source of infection and means of transmission? (1)**
B. Infection source – person virus-carrier. Transmissive way of infection, rare - contact.
C. Source of infection – ill person. Ways of transmission: main - respiratory, rare air-dust or contact, may be alimentary with dairy products.

**Question 8.**
**Choose the right steps of pathogenesis of diphtheria agent? (1)**
A. Infection gate – nasopharynx mucous membrane, where microorganisms multiply and cause local inflammation and necrotic changes. Agent then passes on to the regional lymph glands and by lymphogenic means to the blood, where it produces toxins that provokes hyperemia, skin rash, and damage of central and vegetative nervous system. After 2-3 weeks an infection allergy is formed. The secondary rash appear, body temperature increases, diffuse glomerulonephritis also occurs.
B. Infection gate – nasopharynx mucous membrane, where agent attaches to the epithelium by cord-factor and surface factors of adhesion and multiplies. Microorganisms produce exotoxins that causes specific fibrosis inflammation and can cause serious hives(urticaria). The histotoxin partially damages heart cells, adrenal glands, peripheral nervous system, kidneys, then the occurrence of cellular necrosis, dystrophic processes and functional-morphological damages.
C. Infection gate – stomach mucous membrane, where almost all microorganisms die and only few get to the intestine, multiply and produce mucinase that allows their adhesion to the epithelium. Microorganisms start to produce exotoxin that activates inner-cell adenyl cyclase, increases amount of camp and electrolytes exit and other fluids forms into the intestinal cavity. These excessive fluid increase and release causes profuse diarrhea and vomiting.
D. Infection gate – upper respiratory ways → epithelial cells` invasion → reproduction in the cylindrical epithelial cells of upper respiratory ways, with further destruction → process generalization with spreading to the lower respiratory ways → development of secondary immune deficit that causes secondary bacterial infections → possible occurrence of immune pathologic reactions as a result of immune complex formation.

**Question 9.**
It is known that diphtheria agent produces toxin that breaks translocation process. How does it happen? (1)
A. Agent modifies protein factor of translocation.
B. Agent inhibits translocase.
C. Agent causes translation breaks.
D. Agent inhibits elongation.
E. Agent breaks functioning of aminoacyl-tRNA-synthetizes.

Question 10.
Which methods of diagnostics are appropriate for the laboratory diagnosis of diphtheria in a patient? (2)
A. Bacteriological method by taking a pure culture in media and identification by morphological, tinctorial, biochemical and antigenic properties with obligatory definition of culture toxigenicity.
B. Microscopic method by taking pure culture in media and identification by morphological, tinctorial, biochemical and antigenic properties with obligatory definition of culture toxigenicity.
C. Mycological method by taking a pure culture in Sabouraud media and identification by morphological, tinctorial, biochemical and antigenic properties with obligatory definition of culture toxigenicity.
D. Serological method by identifying specific antibodies in patient`s blood serum against the infection agent.
E. Virology method by taking pure culture on the cell`s medium or in chickens` embryos and identifying of antigens specialties.

Question 11.
Which biomaterial is to be taken from patient for the bacteriologically prove of diphtheria diagnosis? (2)
A. Stool.
B. Vomit mass.
C. Blood.
D. Smear from mucous membrane.
E. Inflammation zone membranes.
F. Pus.
G. Urine.
H. Sputum.

Question 12.
Which media can be used for primary taking of culture prove bacteriologically diphtheria diagnosis? (2)
A. Endo medium.
B. YSA.
C. QVA.
D. Levenstein-jensen medium.
E. Blood-telluric agar.
F. +Loeffler’s medium.

**Question 13.**
Which reaction is used for identifying toxigenicity of diphtheria agent? (1)

A. +Precipitation reaction in gel.
B. Reaction of circle precipitation.
C. Agglutination reaction.
D. Flocculation reaction.
E. Phat.

**Question 14.**
Choose the right components of precipitation in gel. If culture of bacteria Corynebacterium diphtheriae produces exotoxin, how does the positive reaction for it look like? (2)

A. +Reaction components: 1) culture of Corynebacterium diphtheriae; 2) anti-diphtheria antitoxin serum.
B. Reaction components: 1) culture of Corynebacterium diphtheriae; 2) anti-diphtheria agglutinating serum; 3) physical solution.
C. Reaction components: 1) patient’s blood serum; 2) erythrocyte anti-diphtheria diagnosticum.
D. +With positive result of Precipitation reaction there are merging lines in gel.
E. With positive result of Precipitation reaction there are crossing lines in gel.
F. With positive result of Precipitation reaction there are zones of diffuse muddiness.
G. With positive result of Precipitation reaction there are no lines in gel.
H. With positive result of Precipitation reaction there are precipitation circles in gel.
I. With positive result of Precipitation reaction there are sediment with erythrocytes, forming upside down umbrella.

**Question 15.**
Which additional researches are taken to identify diphtheria agent? (4)

A. +Pizu test.
B. +Hemolysis during culture growth in blood agar.
C. Growth in sugar broth.
D. Studying of morphological and tincture features.
E. +Zack’s probe.
F. +Toxigenicity identification.
G. Studying of cultural features.
H. Studying of antigen features.
I. Sensitivity level for antibiotics.

**Question 16.**
In which conditions can Corynebacterium diphtheriae become toxigenic? (1)
A. Chromosome mutation.
B. Cultivation in telluric medium.
C. Passing through sensitive animals` organisms.
D. Cultivation with adding antitoxic serum.
E. +Phage conversion

**Question 17.**
What is phage (lysogenic) conversion or infection inheritance? (1)
A. +Phenomena of changing bacteria features under pro-phage impact.
B. Phenomena of bacteria and fag interaction, causing protein-repressor inactivation.
C. Phenomena of bacteria and fag interaction, causing protein-repressor activation.

**Question 18.**
Choose, in which diagnostics type the serological method of diphtheria diagnosis is used? (3)
A. +For retrospective diagnostics.
B. +For assessment of antitoxin immunity.
C. +Differentiating carrier and acute forms.
D. During manifest diphtheria.
E. With complications occur.
F. To foretell the complications.
G. For cure effectiveness assessment.

**Question 19.**
Which probes can be used for express-diagnostics of diphtheria? (2)
A. +PCR.
B. +ELISA.
C. Express-diagnostics is not taken.
D. PHAT.
E. CFT.

**Question 20.**
Characterize the immunity that will be formed after diphtheria infection. (1)
A. Post-infection, local specific, long-term cell immunity.
B. Post-infection, general, group-specific, humoral.
C. Post-infection, local and general protective cells` and humoral, post bacterial, local and general.
D. Post-infection, type-specific, protective, general.
E. Post-infection, non-protective, short-term, humoral.
F. +Post-infection, humoral, antitoxin, long-term, protective, does not protect against possible carriage.
Note.
In other variants of practically oriented task can be other question, like:

Enumerate the medicines that can be used for specific diphtheria therapy? (2)
A. +Antitoxic serum
B. Immune medicines are not developed.
C. Bacteriophage.
D. Agglutinating serum.
E. Toxoid.
F. +Gamma-globulin.
G. Complex vaccine – APDT, ADT.

How is diphtheria agent colored according to Neisser? (1)
A. +Yellow bacilli with brown spots at the ends.
B. Blue.
C. Deep red in blue background.
D. Violet
E. Rose.

Which medicines are used for specific diphtheria prophylaxis? (4)
A. +APDT.
B. +ADP.
C. +ADP-s.
D. +Diphtheria serum.
E. Immune-biological medicine were not invented.
F. Bacteriophage.
G. agglutinate serum.
H. Eubiotics.
I. Antibiotics.

Which inner structures of diphtheria agent should be studied mostly during microscopy? (1)
A. Spore presence.
B. Capsule presence.
C. Cell wall presence.
D. Flagella presence.s
E. +Volute granules presence.

What are special methods of coloring Corynebacterium diphtheriae? (2)
A. +Coloring by Neisser.
B. +Coloring by Loeffler.
C. Coloring by Zil-Nielsen.
D. Coloring by Buri-Gins.
E. Coloring with methylene blue.
F. Coloring by Ozheshko method.
G. Coloring with Pfeifer fuchsine.

**Is skin-allergic probe taken in diphtheria cases? (1)**
A. +No.
B. Yes, mantoux test.
C. Yes, burne test.
D. Yes, pirquet`s test.

**Which methods are used to study antitoxic immunity to diphtheria? (2)**
A. +Schick`s test.
B. +Serological method.
C. Bacteriological method.
D. Biological method.
E. Dick`s probe

For diphtheria agent (toxigenic bacteria) there is one feature of tox+- gen presence in genome. Give characteristics for pro-phage. (1)
A. Pro-phage able for reproduction in bacterial cell.
B. DNA pro-phage that can transcribe itself.
C. Pro-phage ruins bacteria.
D. Phage can exist in autonomic way.
E. +DNA phage that is integrated into DNA bacteria.

For diphtheria prophylaxis, according to the vaccination calendar an APDT vaccine should be given to a child. Characterize the vaccine`s components? (1)
A. +Inactivated whooping cough vaccine, diphtheria and tetanus toxoid.
B. Live (attenuated) whooping cough vaccine, diphtheria and tetanus toxoid.
C. Whooping cough, diphtheria and tetanus toxoid.
D. Inactivated whooping cough vaccine, and live diphtheria and tetanus vaccines.
E. Whooping cough vaccine, diphtheria and tetanus antitoxic sera.

**Characterize immunity features after diphtheria toxoid. (1)**
A. +Post-vaccine, active, general, humoral, antitoxic.
B. Post-vaccine, passive, general, humoral, antitoxic.
C. Post-vaccine, active, local, humoral, antitoxic.
D. Post-vaccine, active, general, humoral, antibacterial.
E. Post-vaccine, passive, general, humoral, antitoxic.

**Choose right composition of diphtheria anatoxin: (1)**
A. +Includes exotoxin of Corynebacterium diphtheriae neutralized by formalin (0,4%) and high temperature for a duration of 4 weeks.
B. Includes antibodies against neutralized exotoxin of Corynebacterium diphtheriae by formalin (0,4%) and high temperature for a duration of 4 days.
C. Includes pure neutralized culture of Corynebacterium diphtheriae.
D. Includes pure attenuated culture corynebacterium diphtheriae.
E. Includes K-antigen of Corynebacterium diphtheria agent.

**During diphtheria diagnostics, IFT is used. It is used for:** (2)
A. +Fast infection diagnosis.
B. +Finding of bacteria antigens in pathological material.
C. Taking skin-allergic tests.
D. Curing infection.
E. Titrating of antitoxin sera.

**Choose components used in IFT for identifying antibodies during serological diphtheria diagnostic:** (4)
A. +Patient`s blood serum.
B. +Solid phase fixed antigen.
C. +Anti-globulin serum, marked with ferment (ex. Peroxidase).
D. +Substrate and indicator.
E. Non-marked antibodies against immunoglobulins.
F. Marked antibodies against agent`s antigen.
G. Guinean pig blood serum complement.
H. Anti-globulin serum, marked by reversal transcriptase.
I. Hemolytic serum.
J. Sheep`s erythrocytes.

**What is the purpose of flocculation test?** (2)
A. +Antitoxin serum titration.
B. +Diphtheria anatoxin titrating.
C. Serologic diphtheria diagnostics.
D. Bacteriological diagnostics of throat diphtheria.

**The antitoxic serum activity is calculated in:** (1)
A. +Antitoxic unit.
B. Immune unit.
C. Antigen unit.
D. Doses Letalis minima.

Antitoxic diphtheria serum is a heterological medicine, that contains antibodies against diphtheria agent exotoxin and is gotten by hyper-immunization of horses with anatoxin. That vaccine can cause anaphylaxis.

**Choose right method of preventing this:** (3)
A. +Studying individual allergy reactions to medicine.
B. +Injection by bezredko method (desensitization).
C. +Best choice for injection is diphtheria immunoglobulin.
D. Best choice for injection is specific antibacterial serum.
E. Give medicine each day parenteral.
Choose right composition, reaction and method in which erythrocyte diphtheria diagnosticum is used: (2)
A. +Composition: sheep’s erythrocytes with adsorbed antigens of known bacteria.
B. +Used in serological phat diagnostics.
C. Composition: group of killed bacteria.
D. Used in serological CFT test.
E. Composition: sheep’s erythrocytes with adsorbed antibodies against known bacteria.
F. Used for bacterial diagnostics to identify pure culture in agglutination assay on glass.

How is antitoxic diphtheria serum produced: (1)
A. +By hyperimmunization of horses with diphtheria toxoid.
B. By titration in agglutination reaction.
C. By titration in precipitation reaction.
D. Out of donors` blood, after diphtheria toxoid vaccination.
E. Out of donors` blood, after diphtheria killed vaccination.

Choose reactions that are used for identification of post-vaccine antibodies in patients` blood: (2)
A. +ELISA.
B. CFT.
C. +PHAT.
D. AT in test tube.
E. IFT.
F. precipitation test in gel.